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JOURNAL OF THE COLLEGE OF AGRICULTURE
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University of the Philippines

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The Philippine Agriculturist

Journal of the College of Agriculture and Central Experiment Station
University of the Philippines

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FARM INVESTMENT AND INCOME OF RICE FARM OWNER-OPERATORS AND TENANT-OPERATORS [1]

FRANCISCO M. SACAY, LELIS O. LORIA, MANUEL DE LEON, AND TOMAS L. MANGASEP

A study of 230 tenants and 230 owner-operators in one municipality of Ilocos Norte and two municipalities of Tarlac showed that the size of farm, which averaged 1.76 hectares for all farmers, was about the same for owner-operator and tenant. The tenant had an investment of ₱1,221 in the farm business. The owner-operator had a higher total investment because of his higher investment in land and dwelling. Rice was the principal source of income. Although the tenant had higher receipts than the owner-operator, he had much higher expenses so that his net farm income was very much lower. Although the gross farm income of both operators was practically the same, the tenant's labor earnings were about a hundred pesos less. The tenant's lower income explains why he lives in a cheaper dwelling, is unable to educate his children, and has a lower standard of living than the owner-operator.

Several studies have been conducted on the size of farm, farm income, and other farm management aspects of tenant-operated rice farms, but very few have been made on owner-operated rice farms and still fewer on the investment and income of tenant-operators and owner-operators compared. Hence, the surveys reported in this paper were undertaken.

The surveys were conducted in Dingras, Ilocos Norte, and in San Clemente, Tarlac, in 1917 and in Camiling, Tarlac, in 1948. The number of tenants studied was 75 in Dingras, 80 in Camiling, and 75 in San Clemente. In each area an equal number of owner-operators was also studied.

In comparing the businesses of tenant- and owner-operated farms, the records from all the three areas were combined.

DESCRIPTION OF AREAS SURVEYED

Dingras, located in the central part of Ilocos Norte, is considered the rice granary of the province. Because of the high density of population the farms were very small, averaging about 1.29

[1] Central Experiment Station Contribution No. 1871.

THE PHILIPPINE AGRICULTURIST, VOL. 39, No. 9, FEBRUARY, 1956.

hectares. Although the fields were irrigated, the average yield was only about 37 cavans a hectare during the survey year.

Camiling is in the northwestern part of Tarlac. Except for the hilly strips in the northeastern portion, the area is relatively low. The northwestern portion becomes inundated during the rainy season, and a late season crop of rice is produced. To the south is an extensive lowland which is ideal for rice production. Across this area runs the Camiling River, which supplies three main irrigation canals in the rainy season. During the survey, however, the water was not enough for the entire municipality. Because of the irrigation water, the rice yield averaged about 50 cavans, which was much higher than in the two other municipalities surveyed. The average size of farm was 1.87 hectares.

San Clemente is also in the northwestern part of Tarlac and adjoins the municipality of Camiling. It has a communal irrigation system which supplies water during the rainy season. The average yield during the crop year studied was about 35 cavans. The average size of farm was 2.13 hectares.

SIZE OF FARM AND CAPITAL INVESTED

The owner-operator and the tenant had about the same size of farm (table 1). In both groups only a small proportion of the farms were over 3 hectares.

TABLE 1.—*Size of farm*

AREA IN HECTARES	OWNER-OPERATOR	TENANT-OPERATOR
Less than 0.6	7	0
0.6–1.0	51	47
1.1–1.5	58	77
1.6–2.0	54	35
2.1–2.5	20	31
2.6–3.0	19	24
3.1–3.5	6	7
3.6–4.0	6	3
4.1–4.5	2	3
4.6–5.0	2	2
5.1–5.5	3	0
5.6–6.0	1	0
6.1 and over	1	1
Total farms	230	230
Average area (hectares)	1.77	1.75

The capital investment based on the ending inventory was higher on the owner-operated farms than on the tenant-operated farms by about ₱500 (table 2). Whereas the owner-operator owned the entire investment on his farm, the tenant owned only about 23 per cent of the amount invested in the farm he operated. His average investment was ₱1,221. This amount was invested largely in work animals and dwelling.

TABLE 2.—*Farm investment in pesos*

FORM OF CAPITAL	OWNER-OPERATOR	TENANT-OPERATOR
Land	4,169	4,173 [a]
Buildings	680	307
Tools	161	122
Work animals	690	625
Other livestock	168	143
Seeds and supplies	23	24
Total investment	5,891	5,394

[a] Owned by landlord.

CROPS GROWN AND LIVESTOCK RAISED

The farm was planted largely to rice, the principal crop (table 3). Other important crops grown were corn and sugar cane. The area planted to crops by the tenant and the owner-operator was practically the same.

TABLE 3.—*Major crops raised*

CROPS	OWNER-OPERATOR	TENANT-OPERATOR
Farm crops:	*hectares*	
Rice	1.6	1.7
Corn	0.1	0.1
Sugar cane	[a]	[a]
Other	[a]	[a]
Vegetables:	*plants*	
Tomato	34	34
Eggplant	34	37
Ampalaya	15	13
Fruits:		
Banana	10	12

[a] Less than 0.1.

The owner-operator had slightly more work animals and livestock than the tenant (table 4) and had more investment in those items (table 2).

TABLE 4.—*Livestock raised*

KINDS OF ANIMALS	OWNER-OPERATOR	TENANT-OPERATOR
Work animals:		
Carabao	1.8	1.8
Cattle	0.3	0.2
Other livestock:		
Horses	0.1	0.1
Swine	2.2	2.0
Hens	5.6	3.4
Other chickens	7.3	7.0
Ducks	0.5	0.2

FARM RECEIPTS AND EXPENSES

The receipts of both the owner-operator and the tenant came mainly from crops.

The tenant-operator had much higher total receipts than the owner-operator (table 5). This was because the landlord's share was considered as sold and included under receipts. The same amount was included under expenses inasmuch as it was given to the landlord as rent (table 6).

TABLE 5.—*Farm receipts*

SOURCES OF RECEIPTS	OWNER-OPERATOR	TENANT-OPERATOR
Farm crops	₱408.36	₱627.00
Fruits and vegetables	25.00	24.00
Livestock and livestock products	100.00	72.00
Total	₱534.55	₱725.24

TABLE 6.—*Farm expenses*

EXPENSES	OWNER-OPERATOR	TENANT-OPERATOR
Cash expenses	₱100.00	₱ 86.00
Unpaid family labor	29.00	33.00
Net decrease of capital	57.00	12.00
Land rent (landlord's share)		383.00
Harvester's and thresher's share	140.00	166.00
Total	₱326.00	₱683.00

LABOR EARNINGS AND FAMILY INCOME

As has been mentioned, a large proportion of the rice and other products was consumed at home. The farm privileges (including value of farm crops, fruits, vegetables, livestock, and livestock products used at home and rental value of dwelling) of the owner-operator were greater than the farm receipts (table 7). The farm privileges of the tenant-operator were lower because he lived in a less expensive dwelling and had to give a portion of his crop to the landlord for the use of the land.

TABLE 7.—*Labor earnings and family income*

ITEM	OWNER-OPERATOR	TENANT-OPERATOR
Farm receipts	₱ 535	₱ 725
Farm privileges	681	465
Farm receipts plus privileges	1,215	1,190
Farm expenses	327	683
Net farm income plus privileges	889	507
Interest at 6 per cent on operator's investment	349	71
Operator's labor earnings	540	436
Operator's income from job off farm	189	123
Total operator's income	729	559
Income of other family members:		
From farm (unpaid labor charged expenses)	29	33
From other sources	49	16
Interest earned by operator's capital (excluding interest on dwelling)	314	54
Total family income	₱1,121	₱ 662

Because the tenant had to pay land rent, his total family income was only ₱662. This low income explains why he lives in a cheaper dwelling, is unable to educate his children, and has a lower standard of living than the owner-operator.

Science begins and ends with the admission of ultimate uncertainty—and it remains our surest means of knowledge and effective control.

Herbert J. Muller

SOME ASPECTS OF AGRICULTURAL LOANS GRANTED BY FIVE RURAL BANKS IN THE VISAYAS AND MINDANAO, 1953 [1]

MARCELO V. AQUINO

The 200 loans studied were granted to 165 owner-operators and 35 tenant-operators. The average amount of the loans was ₱450. Almost 55 per cent of the loans matured in five months or less. The most common purpose stated for the loans was for real estate improvement. Almost all of the loans were granted with land and other property as security. The banks tended to give larger loans to the landlords, perhaps because of their ownership of land. The annual interest rates ranged from 10 to 12 per cent.

The lack of adequately financed credit institutions in Philippine rural areas and the too exacting collateral requirements leave the farmers no alternative except to borrow, often too expensively, from private individuals.

In 1952, laws were passed establishing the Agricultural Credit and Cooperative Financing Administration (ACCFA) and a system of Rural Banks under the supervision of the Central Bank of the Philippines in Manila. Specifically, the Rural Bank Act was enacted to promote and expand rural economy in an orderly and effective manner by providing the people of the rural communities with the means of facilitating and improving their productive activities and by encouraging the organization of cooperatives.

This study was conducted to help government agencies understand better the credit needs and problems of farm operators. Certain characteristics of the operators and their farming operations and of the loans which were granted to them by the Rural Banks were studied.

The data used in this study were copied from 200 agricultural loan application forms from among those received by the Rural Banks of Bacolod, Davao, Sato, Kalibo, and Tagbilaran during their first year of operation, 1952-1953, and from the inspectors' reports and verification sheets. All these papers are on file in the Depart-

[1] Central Experiment Station Contribution No. 1872.

ment of Loans and Credits and Rural Bank Administration of the Central Bank of the Philippines.

CHARACTERISTICS OF OPERATORS

Nationality and residence. All of the 200 applicants were Filipino citizens. Most of them lived near the farms which they operated although some lived in the poblacion.

Tenure. Thirty-five of the applicants were tenants and 165 were owner-operators. There were more owner-operators perhaps because land was an important item of security and the banks gave a large proportion of the loans to landowners. In general, tenant-operators were granted smaller loans than owner-operators (table 1).

TABLE 1.—*Number and size of loans by tenure*

NAME OF BANK	OWNER-OPERATOR		TENANT-OPERATOR	
	Number of loans	Average loans	Number of loans	Average loans
Kalibo	32	₱ 539	2	₱450
Sato	4	450	—	—
Tagbilaran	89	222	22	217
Bacolod	21	1,512	4	545
Davao	19	554	7	196
All banks	165	₱ 491	35	₱264

Experience. About 43 per cent of the 148 farmers who reported on experience had been farming for less than 10 years. Only 3 per cent had farmed for as long as 40 years. There did not seem to be

TABLE 2.—*Farming experience of farmers*

YEARS	OPERATORS	
	Number	Per cent
5 and less	33	22
6–9	31	21
10–14	25	17
15–19	16	11
20–24	20	13
25–29	8	3
30–34	8	3
35–39	3	3
40 and more	4	3
Total	148 [a]	100

[a] Only 148 reported.

any tendency to lend to farmer groups of a particular length of experience (table 2).

CHARACTERISTICS OF FARMS

The size of farm, crops produced, livestock, and equipment were supposed to have been reported by the applicants and appraised by the inspectors before loans could be obtained. But inspection was not done thoroughly even after the farmers had paid inspection fees. This would seem to be a reflection on the management of Rural Banks.

CHARACTERISTICS OF LOANS

Size of loans. The size of the loans granted to farmers was presumably based on the borrower's production record, character, and ability to meet his obligations. The loans granted ranged from ₱20 to ₱5,000, with an average of ₱450.

Most of the loans were relatively small. One-quarter of the farm operators borrowed less than ₱100 (table 3). Only 14 per cent were granted ₱500 and more.

TABLE 3.—*Farmers granted loans according to size of loans*

SIZE OF LOAN	FARMERS	
	Number	Per cent
₱100 and less	51	25
101–200	36	18
201–300	31	16
301–400	19	10
401–500	34	17
501 and more	29	14
Total	200	100

Farmers who asked for ₱100 or less were granted the full amount (table 4). Those who asked for the largest loans were granted 75 per cent of the amount requested.

Term of loans. Periods for which loans were made were short. Maturity dates were adjusted to the time of harvesting and marketing. Of the 200 farm loans granted, 34 were for less than 3 months and only 21 per cent were for 12 months and more (table 5).

Purpose. Almost 35 per cent of the loans requested were for real estate improvement (table 6). This varied from the finding of

TABLE 4.—*Average amounts requested and granted*

SIZE OF LOAN	NUMBER OF LOANS	AVERAGE REQUESTED	AVERAGE GRANTED	PERCENTAGE GRANTED
₱100 and less	51	₱ 62	₱ 62	100
101–200	32	153	146	95
201–300	22	281	279	95
301–400	10	390	344	88
401–500	39	476	428	89
501 and more	46	1,609	1,220	75
All loans		₱ 554	₱ 450	81

TABLE 5.—*Periods of loans granted to farmers*

MONTHS	LOANS	
	Number	Per cent
3 and less	69	34
4–5	39	20
6–7	43	22
8–9	5	2
10–11	2	1
12 and more	42	21
Total	200	100

TABLE 6.—*Purposes for which loans were requested*

PURPOSE	REQUESTS		
	Number	Per cent	Average amount
Purchase of carabao	58	12	₱270
Equipment	41	8	170
Fertilizers	60	12	115
Seeds and seedlings	48	10	155
Land preparation	63	13	341
Real estate improvement	173	34	235
Livestock and fish	27	5	173
Personal expense	21	4	59
Other	8	2	408
Total	499 [a]	100	

[a] Farmers requested loans for more than one purpose.

Mabbun that borrowers tended to use their credit for consumption purposes. It is likely that the purpose stated by the borrower did not always coincide with the actual use of the loan.[2]

[2] Pablo N. Mabbun, *Philippine Agriculturist*, 25, 493 (1936).

Almost 23 per cent of the loans requested were to be used for buying seeds and seedlings and for land preparation and planting.

A further study which may prove interesting and useful would be the determination of the actual utilization of the loans and how these loans have affected the farming business of the operators.

Security. The security offered by the farm operators was usually real estate, provided that no Torrens title was required. Other properties and chattel mortgages on the harvest of crops and on livestock were also given as security. Manulat found that the majority of the farmers in Naghalin, Kanangga, Leyte, gave no collateral for security.[3] A few loans were obtained using real estate and a promissory note.

A total of 145 farmers offered land as security (table 7). Twenty-seven others offered other forms of security; 28 did not state any security on their application.

TABLE 7.—*Kinds and amounts of security offered by farmers*

SIZE OF LOAN	SECURITY	
	Land	Other
₱100 and less	24	16
101–200	21	9
201–300	26	2
301–400	16	0
401–500	32	0
501 and more	24	2
Total	145	27

Source of payment. The main source of funds for the payment of loans was the sale of crops. Minor sources were business, land, livestock, etc. Most of the farmers expected payment funds from the sale of coconuts and palay (table 8).

Interest. The annual interest rates ranged from 10 to 12 per cent. They did not vary appreciably with changes in the size of loan (table 9). The consistent 10 to 12 per cent rate is in marked contrast to the rates as high as 200 per cent reported by Mabbun in Aparri, Cagayan.[4]

[3] Mario V. Manulat, *Philippine Agriculturist*, 38, 471 (1954).
[4] Mabbun, *op. cit.*

TABLE 8.—*Sources of payment*

SIZE OF LOAN	SOURCE						
	Coconut	Palay	Corn	Land	Business	Livestock	Other
₱100 and less	1	[a]	1	[a]	[a]	[a]	1
101–200	3	5	4	[a]	1	[a]	15
201–300	21	20	5	[a]	6	4	16
301–400	4	9	4	[a]	6	[a]	8
401–500	14	25	6	1	3	[a]	8
501 and more	7	17	6	1	[a]	[a]	16

[a] No information.

TABLE 9.—*Interest rates*

SIZE OF LOAN	NUMBER	AVERAGE INTEREST RATE
₱100 and less	53	10.2
101–200	32	11.7
201–300	32	11.7
301–400	20	12.0
401–500	33	11.9
501 and above	30	11.4
Average		11.6

Fees. Of the 200 farm borrowers 86 did not report inspection fees. Only 4 per cent reported notarial fees. Fees for inspection and notarial services tended to increase with the size of loans (table 10).

TABLE 10.—*Kinds and amounts of fees*

SIZE OF LOAN	INSPECTION FEE		NOTARIAL FEE	
	Number of cases	Average paid	Number of cases	Average paid
₱100 and less	4	₱ 7.00	49	₱ 2.30
101–200	10	6.80	12	2.40
201–300	27	5.48	12	3.00
301–400	19	6.68	9	3.60
401–500	30	6.97	14	3.30
501 and more	21	12.04	2	12.00

ANAPLASMOSIS AMONG DAIRY CATTLE IN THE UP COLLEGE OF AGRICULTURE [1]

F. S. Mensalvas and G. V. Garcia

Anaplasmosis is also known by other names, namely, yellow teat disease and gall sickness. The synonyms spring no doubt from symptoms which generally characterize the infection, such as a decidedly yellow tinge on some hairless parts of the body, like the teats, and a markedly distended gall bladder filled with yellowish brown bile of a mucilaginous nature.

This disease attacks mostly adult cattle; infection of calves under one year old is usually the exception rather than the rule (Hagan and Bruner, 1951). Besides cattle, buffaloes and Zebus are also susceptible (Hutyra *et al.*, 1946), as well as goats, sheep, antelopes, camels, deer, and other animals (Seiden, 1952).

The etiological agent is believed to be an anaplasma body which is carried from a sick to a healthy susceptible animal by ticks, stable flies, horseflies, and mosquitoes. The role played by these insect vectors appears to be a mechanical one. It is not surprising, therefore, that even man has been mentioned as an important agent of spread. Outbreaks of the disease have been traced to such surgical operations as blood letting, dehorning, castration, ear tagging, and even vaccination when the wounds come in contact with contaminated instruments.

The only species of the causative agent present in the United States is *Anaplasma marginale,* which is the only distinct pathogen of the group referred to as "marginal bodies." In South Africa, and perhaps in other parts of the East as well, the *Anaplasma centrale,* which is nonvirulent, also occurs. As the name suggests, the latter body appears at the center of the affected erythrocyte to which both *A. marginale* and *A. centrale* have great affinity. *A. centrale* appears near the margin of the red blood corpuscles.

A. marginale was found infecting the erythrocytes of cattle of the College dairy herd at Los Baños, Laguna. Since the infection made its appearance for the first time in the herd shortly after the

[1] Central Experiment Station Contribution No. 1873.

introduction of a number of water buffaloes from India, it is not illogical to entertain the possibility that the disease was brought in by these imported animals. Considering that the herd had been tick-free for a number of years, the only agents of spread could have been the flies or mosquitoes which abound in the locality.

HISTORY AND SYMPTOMS

Two Holstein bulls of the College herd were the first animals to become sick with anaplasmosis last October, 1955. The infection was of the acute type characterized principally by depression, inappetence, and indolence. The younger of the two bulls had a body temperature of 106.5°F., and the older one had a body temperature of 105.0°F. A Brown Swiss cow appeared next to contract the disease. Although showing the same distressing signs, it had a body temperature several degrees lower, from 100.4°F. in the morning to 99.8°F. late in the afternoon. This animal died soon after. Following the initial appearance of the infection, other members of the dairy herd also started to show symptoms of the disease. During the height of the contagion there hardly was a day without one or two animals being found sick either at the barns or in the pastures.

In all of the affected animals marked anemia as shown by pale mucosa was evident. Icterus was also present, this being readily detected from the color of skin of some hairless parts of the body like the teats, vulva, medial surfaces of the thighs, and commissures of the mouth. Heart action in some of the infected cattle was fast and pounding. The Brown Swiss cow, for instance, had a heart beat rate of 102 a minute. Breathing in all animals was labored, and the muzzles were dry. Acute depression, tremors of the muscles, loss of appetite, and, invariably, an abrupt decrease in milk flow in lactating cows were observed. Loss of weight was pronounced with marked dehydration. Drooling of saliva was noted in two or three animals, and so was constipation. At least one cow, Holstein No. 10, aborted as a result of the infection. Hemoglobin test (Talquist scale) conducted by the Bureau of Animal Industry on some of the animals showed a reading of as low as 45 per cent. Others with symptoms but with blood negative for *Anaplasma marginale* had a hemoglobin reading of about 50 per cent.

According to Seiden (1952), the hemoglobin index (Talquist scale) is about 80 in normal animals; in sick ones it may drop to as

low as 20. Similarly, the normal erythrocyte count may drop from the usual count of 5 to 7 million to 2 million or even less. The mortality rate, according to the same author, may range from 25 to 60 per cent. When 40 to 60 per cent of the red cells are parasiticized, death invariably supervenes; recovery is the rule when the infection of erythrocytes is only 20 per cent or lower.

It is significant that although the young animals of the College dairy herd were permitted to roam about with the infected adult cattle none of them got the disease. This tends to confirm earlier observations by investigators that calves below one year of age seldom get the disease.

According to Refuerzo (1955) the carrier state is important in anaplasmosis. Animals which have recovered from the disease, whether frank or unrecognized, become carriers and, hence, serve as constant sources of infection. Generally, Oriental breeds of cattle, including those which are native to the country, are resistant, whereas those of Occidental origin are susceptible to the disease. Crosses with admixtures of Occidental blood have, likewise, been found to be susceptible. Two crosses (½ Red Sindhi and ½ Holstein) in the College dairy herd became diseased.

LESIONS

Significant lesions exhibited were swollen and soft spleen with molasses consistency; somewhat taut liver of mottled mahogany color; distended gall bladder which was filled with yellowish brown to yellowish green bile; flabby and echymossed heart; emphysematous lungs; and swollen and edematous lymph glands. The dysfunction of the liver, no doubt, was responsible for the marked jaundice found in all six carcasses autopsied.

TREATMENT

The line of treatment followed consisted of subcutaneous injection of babesan (1 cc. for every 60 kg. body weight) at the brisket followed by intramuscular injection of 20 per cent sodium cacodylate solution (20 cc. for every 100 kg. body weight). The parenteral administration of babesan was done only once, and that was on the first day of treatment; that of sodium cacodylate solution was once every three days until three to five administrations had been given, depending upon the condition of the animal.

A few minutes after the injection of babesan some reactions to the drug were observed. These were salivation, twitching of the lips, restlessness, and, in some cases, muscular tremors. Severe reactions, which were exhibited by some animals, were controlled by intramuscular administration of 1:1000 adrenalin hydrochloride solution (5 to 8 cc. for every adult animal). Since there was complete inappetence in most of the animals affected, subcutaneous injections of 5 per cent dextrose in saline solution at the rate of 200 to 500 cc. daily and forced concentrate feeding in the form of slop were resorted to. Water was made available to the animals at all times. Most of the animals treated regained their appetites after a few days and are now recovering. Out of 32 animals treated 6 died, representing a mortality loss of 19 per cent.

REFERENCES

DYKSTRA, R. R. 1946. Animal sanitation and disease control. Rev. ed., 568 p. Danville, Illinois: The Interstate Printers.

HABERMAN, J. J., AND M. L. HOLCOMB. 1953. The farmer's veterinary handbook. xi + 305 p. New York: Prentice-Hall, Inc.

HADLEY, F. B. 1939. Principles of veterinary science. 3rd ed., 594 p. Philadelphia and London: W. B. Saunders Company.

HAGAN, W. A., AND D. W. BRUNER. 1951. The infectious diseases of domestic animals. 2nd ed., xxx + 920 p. Ithaca, New York: Comstock Publishing Associates.

HUTYRA, F., J. MAREK, AND R. MANNINGER. 1946. Special pathology and therapeutics of the diseases of domestic animals. Vol. 1. 6th ed., xvi + 962 p. Chicago: Alexander Eger Inc.

REFUERZO, P. G. 1955. Anaplasmosis and babesiosis of cattle. B.A.I. Recorder 17 (3): 8-12.

SEIDEN, R. (ed. & compiler). 1952. Livestock health encyclopedia. Springer Publishing Co.

Roughly stated, the scientific method is to go and look, and then look again. The most elaborate experiments and abstruse equations are designed to answer the simple question, "What are the facts?"

Herbert Muller

THREE INSECTICIDES IN THE CONTROL OF INSECTS AFFECTING LOWLAND RICE [1]

FELICIANO B. CALORA

Parathion, TEPP, and toxaphene caused rapid yellowing of the leaves. The three- and six-spray schedules of parathion, TEPP, and toxaphene lowered significantly the percentage of leaf damage by leaf folder. The three- and six-spray schedules of toxaphene and parathion reduced stem borer damage significantly. Parathion applied six times significantly reduced damage by stem borer and leaf folder than when applied three times. The three insecticides did not significantly reduce rice bug damage on the panicles or affect the yield. It is suggested that in similar future experiments more replications be made so that small differences at equal levels of significance may be detected.

Laboratory tests showed that parathion was the fastest in killing the larvae of rice leaf folder and rice stem borer and the nymphs and adults of rice bug.

Otanes and Sison (1941) estimated that in the Philippines, the combined damage of rice stem borer and rice bug amounts to at least 30 per cent of the crop. Damage in Taiwan from borers alone varies from 20 to 40 per cent of the crop.[2] In Southern India it may vary from 3 to 65 per cent; in certain fields losses may be as high as 87 to 90 per cent. (Ramakrishma Ayyar and Anantarayanan, 1937).

While insecticides are now used on rice in other countries (Kuwayama, 1954; Shen and Kung, 1954; Smith and Clifford, 1951), their use is practically unknown to most farmers in the Philippines. This study was conducted in the lowland rice field of Mr. Simplicio V. Revilla in San Isidro, Bay, Laguna, and in the Department of Entomology from December, 1953, to January, 1955, to determine the effects of three insecticides (1) on *Cnaphalocrosis medinalis* Guenée, *Schoenobius incertulas* Walker, and *Leptocorisa acuta* Thunberg; (2) on the rice plants; and (3) on the yield.

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[2] C. P. Clausen, *USDA Cir.*, 168, 115 (1931).

MATERIALS AND METHODS

Parathion (Folidol E-605, an emulsifiable concentrate containing 46.7 per cent parathion), TEPP (Shell Bladex F-2, containing 20 per cent tetraethyl pyrophosphate), and an emulsifiable concentrate containing 60 per cent toxaphene were used in the field tests.[3] Resitoxaphene [4] containing 60 per cent toxaphene was used in the laboratory tests after the supply of 60 per cent toxaphene emulsifiable concentrate had run out. Folidol was used at the rate of 4 cc. to a gallon of tap water, Bladex, at the rate of 9.5 cc., and toxaphene and Resitoxaphene, 3.2 cc. to a gallon of water.

Seedlings of Malagkit Sung-song were planted 25 centimeters each way in 500 square meters of land. The field was divided into three randomized blocks. Each block contained three plots sprayed three times at two-week intervals, three plots sprayed six times at weekly intervals, and one untreated plot.

Rice leaf folder appeared on the plots a month after transplanting. However, spraying was not started until 60 days after transplanting so that the last treatment would protect the rice panicles.

The plots were drained before spraying. After spraying, the water was again let in to a level maintained at 2 to 4 inches. Care was taken to avoid contamination of the nearby paddies with irrigation water and spray mist.

The herbicidal effect of the insecticides on the plants was observed after each spraying. Two weeks before harvesting, the damaged and undamaged leaves were counted in 50 hills chosen at random from each plot. The percentage of damaged panicles in 50 hills in each plot was taken a day before harvesting. A panicle containing a single grain attacked by rice bug was considered damaged. The percentage of bored stalks and those with "white heads" was also taken on 50 hills chosen at random in each plot. The yield of the hills in each plot, except the border rows, was weighed after threshing and winnowing.

In the laboratory tests 10 larvae each of rice leaf folder were placed on the leaves of seven potted plants. One pot was left unsprayed for the control. Five nymphs and five adults of the rice bug were introduced in each of seven cages each containing a vial

[3] Folidol E-605 was obtained from Philippine Factors, Inc., Shell Bladex F-2 from Shell Co., and the emulsifiable concentrate containing 60 per cent toxaphene from Hercules Powder Co., Inc.

[4] A Shell Co. product.

of water with five panicles in the milk stage. The control vial was left untreated. Five larvae of the stem borer were introduced, one to each tiller, between the leaf sheaths and stalks of seven potted plants with five tillers each. Twenty-four hours later, six plants were treated, and the seventh served as control.

RESULTS AND DISCUSSION

Field tests

Weather conditions during the sprayings. The weather was unfavorable during the spraying operations. It rained for three days after the second spraying of the plots sprayed three times and the third spraying of the plots sprayed six times. The fourth spraying of the plots sprayed six times was again succeeded by a heavy rain. Within this period the grains were in the milk stage, which is the stage most susceptible to the attack of rice bugs. The height of rice bug infestation was during this period. It is likely that the rain washed off some of the spray materials and reduced considerably their residual activity.

TABLE 1.—*Effectiveness of three insecticides against rice leaf folder based on transformed angles of percentages of damaged leaves*

TREATMENT	BLOCK			TOTAL	MEAN	MEAN [a]
	I	II	III			
Control	20.27	21.81	23.89	65.97	21.99	14.0
Parathion 3×	14.42	19.46	11.39	45.27	15.09	6.8
Parathion 6×	8.91	10.31	12.11	31.33	10.44	3.3
TEPP 3×	15.79	17.56	12.52	45.87	15.29	7.0
TEPP 6×	6.80	16.74	11.83	35.37	11.79	4.2
Toxaphene 3×	15.56	15.79	16.32	47.67	15.89	7.5
Toxaphene 6×	12.79	12.52	12.39	37.70	12.57	4.7
Total	94.54	114.19	100.45	309.18		

[a] Represents original data in per cent.

Analysis of variance (angles)

SV	DF	SS	MS	COMPUTED F
Block (B)	2	29.04	14.52	2.21
Treatment (T)	6	258.59	43.10	6.56
B × T	12	78.81	6.57	
Total	20	366.44		

SMD (T) at 5% = 4.55

Herbicidal effect of insecticides. After spraying in the field the plants showed no apparent injury. However, when the rice was in the late dough stage, leaves of the treated plants yellowed more rapidly than those of the control.

Effect on leaf folder. The percentages of damaged leaves, damaged stalks, and undamaged panicles were transformed to angles corresponding to percentages as given by C. I. Bliss (Snedecor, 1946).

All the treatments against rice leaf folder were significantly better than the control (table 1). The decrease in infestation occasioned by the insecticides sprayed six times was as follows: parathion, 10.7 per cent, TEPP, 9.8 per cent, and toxaphene, 9.3 per cent. The insecticides sprayed three times reduced the infestation as follows: parathion, 7.2 per cent; TEPP, 7.0 per cent; and toxaphene, 6.3 per cent. Only parathion significantly reduced infestation in the six-spray schedule over the three-spray schedule.

Effect on rice stem borer. Rice stem borer attacked a few of the plants a month after transplanting. Table 2 shows that toxa-

TABLE 2.—*Effectiveness of three insecticides against rice stem borer based on transformed angles of percentages of damaged stalks*

TREATMENT	BLOCK			TOTAL	MEAN	MEAN [a]
	I	II	III			
Control	20.96	22.55	34.70	78.21	26.07	19.3
Parathion 3×	15.34	19.00	13.94	48.28	16.09	7.7
Parathion 6×	9.46	4.44	6.80	20.70	6.90	1.4
TEPP 3×	20.44	20.79	20.44	61.67	20.56	12.3
TEPP 6×	14.30	14.77	18.05	47.12	15.17	7.3
Toxaphene 3×	10.94	8.72	7.71	27.37	9.12	2.5
Toxaphene 6×	8.33	4.44	4.80	17.57	5.86	1.0
Total	99.77	94.71	106.44	300.92		

[a] Represents original data in per cent.

Analysis of variance (angles)

SV	DF	SS	MS	COMPUTED F
Block (B)	2	9.89	4.95	0.39
Treatment (T)	6	1,007.15	167.86	13.21 [b]
B × T	12	152.48	12.71	
Total	20	1,169.52		

[b] Highly significant.

SMD (T) at 5% = 6.34

phene and parathion reduced borer damage significantly. TEPP significantly reduced damage when applied six times but not when applied only three times. On the plots that received six sprayings, the mean percentage reductions of damaged stalks by the insecticides were as follows: toxaphene, 18.3 per cent; parathion, 17.9 per cent; and TEPP, 12.0 per cent. When sprayed three times, toxaphene reduced the damage to 16.8 per cent; parathion, 11.6 per cent; and TEPP, 7.0 per cent. Only parathion significantly reduced infestation in the six-spray schedule over the three-spray schedule.

Effect on rice bug. Rice bugs considerably damaged the grains in the experimental plots. The insect attack started during the milk stage of the plants and continued until the maturity of the grains. The six treatments increased the percentages of undamaged panicles, but the increases were insignificant (table 3). It is suggested that more replications be made in future experiments of this type so that small differences at equal levels of significance may be detected.

TABLE 3.—*Effectiveness of three insecticides against rice bug based on transformed angles of percentages of undamaged panicles*

TREATMENT	BLOCK			TOTAL	MEAN	MEAN [a]
	I	II	III			
Control	7.49	27.49	16.74	51.72	17.24	8.8
Parathion 3×	45.11	24.12	44.54	113.77	37.92	37.8
Parathion 6×	45.00	46.89	44.89	136.78	45.59	51.0
TEPP 3×	24.65	14.30	36.39	75.34	25.11	18.0
TEPP 6×	42.19	30.53	41.90	114.62	38.21	38.3
Toxaphene 3×	43.51	45.75	16.00	105.26	35.09	33.0
Toxaphene 6×	44.25	36.63	34.14	115.02	38.34	38.5
Total	252.20	225.71	234.60	712.51		

[a] Represents original data in per cent.

Analysis of variance (angles)

SV	DF	SS	MS	COMPUTED F
Block (B)	2	51.93	25.96	.23
Treatment (T)	6	1,642.04	273.67	2.39
B × T	12	1,374.13	114.51	
Total	20	3,068.10		

Yield. All the treatments insignificantly increased the yield over the control (table 4). It is suggested, therefore, that more replications be made in future experiments of this type.

TABLE 4.—*Average yield of grains to a hill in grams based on number of hills planted in 12.5 square meters*

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
Control	13.7	15.8	13.5	43.0	14.3
Parathion 3×	17.4	17.7	17.8	52.9	17.6
Parathion 6×	19.4	16.4	18.0	53.8	17.9
TEPP 3×	14.8	16.2	13.9	44.9	15.0
TEPP 6×	18.1	15.2	16.0	49.3	16.4
Toxaphene 3×	15.4	16.4	17.5	49.3	16.4
Toxaphene 6×	14.6	19.7	20.6	54.9	18.3
Total	113.4	117.4	117.3	348.1	

Analysis of variance (angles)

SV	DF	SS	MS	COMPUTED F
Block (B)	2	1.5	.8	.3
Treatment (7)	6	40.8	6.8	2.2
B × T	12	36.6	3.1	
Total	20	78.9		

Laboratory tests

On larvae of rice leaf folder. Parathion killed the larvae more rapidly than either toxaphene or TEPP (table 5). After 72 hours all the larvae on the treated plants were dead. The larvae were successful in folding the leaves. Some were able to feed slightly before they died. Others died instantaneously after crawling over the leaves. It was noted that larvae on the parathion-treated leaves fed for a short time on the folded leaves, crawled all over, and started feeding again. Toxaphene killed all the larvae within 96 hours, and TEPP within 168 hours. In both cases, leaves of the treated plants were folded and the larvae were able to feed on the surface of the folded leaves. On all of the check plants, not one larva died during the experiment. All of the leaves were folded from tip to base and the larvae fed heavily.

On nymphs and adults of rice bug. A complete kill was observed within 48 hours for the adults and within 72 hours for the

TABLE 5.—*Effectiveness of three insecticides against three rice pests in laboratory tests*

INSECTICIDE	INSECT	INSECTS KILLED AFTER INDICATED HOURS										REMARKS
		2	6	12	24	48	72	96	120	144	168	
Parathion	Rice leaf folder larvae	9	21	52	57	59	60					Larvae folded leaves and fed slightly.
	Rice bug nymphs	0	7	18	25	29	30					Nymphs fed on grains.
	Rice bug adults	4	13	25	27	30						Adults fed on grains and some laid eggs.
	Stem borer larvae	0	0	0	25	30						Larvae bored into stalks and fed.
TEPP	Rice leaf folder larvae	2	5	25	30	34	47	54	57	59	60	Larvae folded leaves and fed.
	Rice bug nymphs	0	3	4	5	9	12					Nymphs fed on grains; 18 turned adult and did not die.
	Rice bug adults	0	1	7	11	13	20	24	25	26	28	Adults fed on grains; some laid eggs; 2 did not die.
	Stem borer larvae	0	0	0	14	19	22	29	29	30		Larvae bored into stalks and fed.
Toxaphene	Rice leaf folder larvae	3	6	27	39	51	58	60				Larvae folded leaves and fed.
	Rice bug nymphs	0	0	0	3	15	19					Nymphs fed on grains; 11 turned adult and did not die.
	Rice bug adults	0	1	2	3	9	19	20	24	24	28	Adults fed on grains; some laid eggs; 2 did not die.
	Stem borer larvae	0	0	0	12	18	24	27	29	30		Larvae bored into stalks and fed.

nymphs on parathion-treated panicles (table 5). TEPP and toxaphene had comparatively low toxicity on both nymphs and adults. Of the 30 nymphs introduced on the TEPP-treated panicles, only 12 died within 72 hours; of 30 adults, 28 died within 168 hours. On toxaphene-treated panicles, 19 nymphs died within 72 hours and 28 adults within 168 hours. On both TEPP- and toxaphene-treated panicles, the remaining nymphs that survived after 72 hours turned into adults after 96 hours. Although complete kill had not been attained on TEPP- and toxaphene-treated panicles after 168 hours, the observation was stopped because some insects in the control cages died of starvation. All of the insecticides showed repellent action on both nymphs and adults. It was particularly noted that nymphs were more highly repelled by the TEPP treatment than adults.

On larvae of rice stem borer. Parathion took the shortest time to kill the larvae (table 5). A complete kill was obtained two days after treatment. All the larvae on the TEPP- and toxaphene-treated plants died after six days. Only the larvae that fed between the leaf sheaths and the stalks were killed a day after treatment, and those that died later were those that fed inside the stalks. Not a single larva died in the control during the experiment. No repellent action of the insecticides was observed on the larvae.

LITERATURE CITED

KUWAYAMA, G. 1954. Investigations on the insect pests of rice plant in Hokkaido and their control. Hokkaido Nat. Agric. Exper. Sta. Rept. No. 46: 101-106.

OTANES, F. Q., AND P. L. SISON. 1941. Pests of rice. Jour. Philippine Agric. 17: 211-259. *Cited in* FAO Development Paper No. 14.

RAMAKRISHMA AYYAR, T. V., AND K. P. ANANTARAYANAN. 1937. The stem borer pest of rice (*Schoenobius incertellus*) in South India. India Agric. Livestock 7: 171-179.

SHEN, T. H., AND P. KUNG. 1954. Rice production and improvement in Taiwan. Internat. Rice Commission News Letter 9: 4-16.

SMITH, F. F., AND P. A. CLIFFORD. 1951. Translocation of parathion on foliage application. Rev. Applied Entom. 29: 141-188.

SNEDECOR, G. W. 1946. Statistical methods. 4th ed., xvi + 485 p. Ames, Iowa: The Iowa State College Press.

SWEET CORN IN THE PHILIPPINES [1]

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WITH ONE TEXT FIGURE

In performance trials for yield, agronomic characters, and quality of 13 varieties and hybrids of sweet corn, the top crosses of Hawaii Sweet × Golden Cross Bantam and Philippine Sweet × Golden Cross Bantam showed the best quality and were among the eight highest yielders, all of which yielded alike within the limits of statistical significance at the 1 per cent level. Sweet corn was preferred to glutinous corn by 80 per cent of the members of the panel.

The only local variety of sweet corn is the open-pollinated Philippine Sweet. This variety is vigorous, well adapted to growing conditions in the Philippines, and a high yielder, but it is of poor quality and has a tough pericarp. Another tropical variety, Hawaii Sweet, is of better quality and tenderness but yields less. Sweet corn hybrids from the United States are the best for quality but are not well adapted to the Philippines and are relatively low yielders.

This paper reports the results of an experiment conducted in the Plant Breeding Division and in the Central Experiment Station. The objects of this study were to produce hybrids between varieties of sweet corn, to produce top crosses of these varieties with introduced inbred lines of sweet corn, and to test the performance of all the hybrids. It was expected that some of the hybrids would combine the best quality with good yield and result in a desirable new crop. Boiled green ears of glutinous or waxy corn are widely eaten in the Philippines, and it is hoped that sweet corn might be liked also as another fresh palatable food.

MATERIALS AND METHODS

Crosses were made in the dry season from November, 1954, to February, 1955. Yield and performance trials of the varieties and crosses were conducted in the wet season from June to August, 1955.

The following crosses were made:

Philippine Sweet × Hawaii Sweet
" " × Golden Cross Bantam

[1] Central Experiment Station Contribution No. 1875.

Philippine Sweet × P39
" " × P51
" " × C30 (little seed)
" " × C8 (little seed)
Hawaii Sweet × Philippine Sweet
" " × Golden Cross Bantam
" " × P39
" " × P51
" " × C30
" " × C8

Philippine Sweet and Hawaii Sweet are open-pollinated varieties. Golden Cross Bantam (P39 × P51) is a high-quality sweet corn single cross from the United States. P39, P51, C30, and C8 are widely used U.S. inbred lines and are included in many popular hybrid pedigrees.

Only 10 of the above 12 crosses produced sufficient seed for a yield test. These, together with Philippine Sweet, Hawaii Sweet, and Golden Cross Bantam, made a total of 13 entries. The entries were arranged at random in each of three replications. Each plot had 10 × 4 hills 1 meter apart with rows also 1 meter apart. The two center rows were harvested and weighed for yield, whereas each border row was utilized for quality tests.

Seed was dusted with Ortho HL 762. Five kernels were planted in each hill on June 9, 1955. Two weeks later they were thinned to three seedlings per hill. The plots were uniformly cultivated, hoed, and fertilized. Unfortunately, all corn plots in the Experiment Station were sprayed on June 20 with 2,4-D, which injured the sweet corn. The plants were stunted and twisted for several days, but they gradually recovered and made a good vigorous growth which finally resulted in an excellent yield.

The plots were inspected each day to ascertain silking date, when more than half of the plants in each plot had silked. Height of plants was measured from ground level to the tip of the tassel. The length of ear was measured from ground level to the node to which the upper ear was attached. Ten plants were measured in each plot and their heights averaged.

Stalk leaning and stalk breaking at harvest were recorded. The former included stalks leaning 30° or more, and the latter, those

broken below the ear. The plots were observed frequently for diseases and pests.

Plots were harvested 17 days after half-silking. "Green" ears, including the inner husks, were weighed, and the number of ears in each plot was recorded.

Panels of 13 to 15 members each were organized to rate the quality of the varieties and hybrids. The panels on August 10, 12, and 15, the dates of the best harvests, rated only six varieties each day so as to avoid fatigue. The six earliest varieties were ready for the August 10 panel. Three of these were also rated by the second panel. Two of the August 12 varieties were included in the August 15 test together with the last four varieties to mature.

RESULTS

The experimental results are summarized in table 1.

The stand was excellent, varying from 94 per cent to 99 per cent.

Hectare yields of green corn mature enough for eating ranged from 7,870 to 5,496 kg. per hectare. Philippine Sweet and seven of the hybrids had yields within the limits of statistical significance at the 1 per cent level starting from the highest yield. Hawaii Sweet × C8 and Golden Cross Bantam yielded significantly less than the others.

Philippine Sweet and its top crosses were consistently higher yielding than Hawaii Sweet and its top crosses. Top crosses with P51 and with Golden Cross Bantam were better than top crosses with P39 and the open-pollinated parents. There was no consistent difference in number of ears per plant between Philippine Sweet and its top crosses as compared with Hawaii Sweet and its top crosses, but the number of ears per plant was appreciably higher in all top crosses than in the open-pollinated parents.

The number of ears ranged from 54,833 per hectare for Philippine Sweet × P51 to 31,333 for Hawaii Sweet. The ears per plant ranged from 1.87 to 1.09.

The ears of Philippine Sweet, Hawaii Sweet, Philippine Sweet × Hawaii Sweet, and Hawaii Sweet × Philippine Sweet had practically no flag leaves, but the ears of Golden Cross Bantam and the hybrids crossed with U.S. inbreds had plenty of long flag leaves (fig. 1).

The number of days from planting to silking ranged from 45 to 55 days. To reach a stage of maturity suitable for boiling, the ears required an additional 17 days.

TABLE 1.—*Summary of performance trial results of sweet corn varieties and hybrids*

HYBRID OR VARIETY	STAND	HEIGHT		LEANING STALKS	BROKEN STALKS	DAYS HALF SILK	EARS PER HECTARE	EARS PER PLANT	YIELD PER HECTARE
		Tassel	Ear						
		cm.	*cm.*	%	%				*kg.*
Philippine Sweet × P51	98	219	66	4.0	4.0	47	54,833	1.87	7,870
Hawaii Sweet × P51	99	206	68	5.0	1.7	46	52,833	1.77	7,492
Hawaii Sweet × Philippine Sweet	98	250	106	2.8	2.8	52	39,500	1.34	7,409
Philippine Sweet × Golden Cross Bantam	98	217	69	1.7	1.1	47	43,000	1.47	7,364
Philippine Sweet × Hawaii Sweet	96	242	104	5.2	2.9	53	39,000	1.35	7,356
Philippine Sweet	98	245	106	4.0	0.0	55	33,167	1.13	7,318
Hawaii Sweet × Golden Cross Bantam	94	214	66	2.4	0.6	47	49,167	1.74	7,235
Philippine Sweet × P39	99	202	63	2.8	1.1	48	40,167	1.35	7,091
Hawaii Sweet × P39	98	201	63	3.4	1.7	46	45,000	1.53	6,676
Hawaii Sweet × C30	97	213	70	2.9	1.7	46	40,500	1.40	6,471
Hawaii Sweet	96	241	104	1.7	2.3	52	31,333	1.09	6,343
Hawaii Sweet × C8	97	187	57	2.9	0.6	46	36,667	1.26	5,610
Golden Cross Bantam	98	152	29	0.0	0.6	45	33,000	1.12	5,496

SMD 5%—854 kg./ha.
1%—1,157 kg./ha.

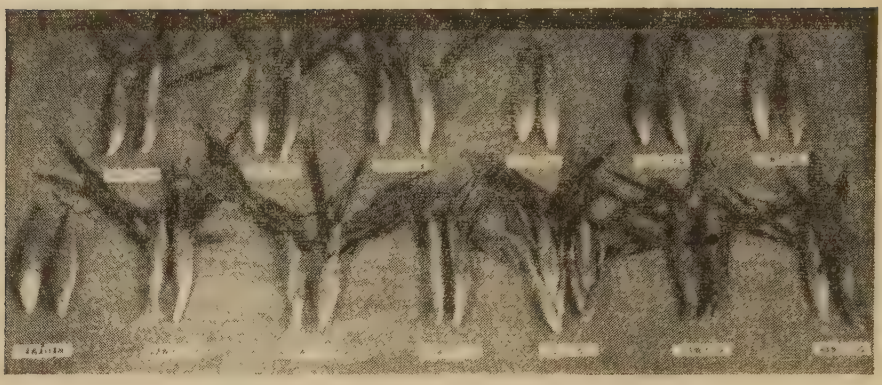

Fig. 1.—Typical ears of Philippine Sweet and Hawaiian Sweet had no flag leaves; hybrids with U.S. inbreds had long flag leaves.

Practically all varieties were erect. Stalk leaning varied only from 0 to 5.0 per cent, and stalk breakage, from 0 to 4.0 per cent.

The average height of the plants ranged from 152 cm. to 250 cm., and the average height of ear nodes, from 29 cm. to 106 cm. Philippine Sweet and Hawaii Sweet were tall, Golden Cross Bantam was very short, and hybrids of U.S. inbreds crossed with Philippine Sweet or Hawaii Sweet were intermediate (table 2).

TABLE 2.—*Summary group ranges of plant and ear heights*

VARIETY OR HYBRID	TASSEL HEIGHT	EAR HEIGHT
	cm.	*cm.*
Philippine or Hawaii (4)	241–245	104–106
Philippine or Hawaii × U.S. (8)	187–219	57–70
U.S. (1)	152	29

Insect and disease damage was insignificant. Corn ear worm, *Heliothis armigera* Hubner, was only occasionally found. A little *Rhizoctonia solani* Kuhn was observed only on Golden Cross Bantam, and it affected yield very little. No downy mildew, *Sclerospora philippinensis* Weston, was found in the plots. Some corn rust, *Puccinia sorghi* Schw., and leaf spot, *Helminthosporium maydis* Nisikado & Miyake, appeared just before harvest but did very little damage.

The nine varieties tested by the first two panels silked 45 to 48 days after planting and were approximately at the same stage of maturity. However, the other four varieties were considerably lat-

er (52 to 55 days), and consequently the ratings of the early and late groups were not strictly comparable. Fortunately, the nine varieties tested by the early panels included the best with respect to quality and flavor (table 3).

TABLE 3.—*Quality rating of nine sweet corn hybrids*

VARIETY	PANEL 1 AUGUST 10	PANEL 2 AUGUST 12
Hawaii × Golden Cross Bantam	1.85	2.13
Philippine × Golden Cross Bantam	—	2.87
Hawaii × P51	3.15	3.13
Golden Cross Bantam	3.23	—
Hawaii × C30	3.69	—
Philippine × P51	—	4.07
Hawaii × P39	3.92	4.53
Philippine × P39	—	4.27
Hawaii × C30	5.15	—

The ratings were remarkably consistent. Hawaii Sweet × Golden Cross Bantam were rated the best in quality and flavor. The four late varieties tested by panel 3 were not exactly comparable to the early varieties, but observation showed that Philippine Sweet, Hawaii Sweet, Philippine × Hawaii, and Hawaii × Philippine were much poorer in quality than when U.S. inbreds were used in the hybrids. Of the late varieties Hawaii Sweet was the best.

Members of the panel were also asked whether they preferred sweet corn or boiled green ears of glutinous corn. Table 4 shows that 80 per cent expressed preference for sweet corn even though their custom was to use glutinous corn.

TABLE 4.—*Preference for glutinous or sweet corn*

PANEL	GLUTINOUS PREFERRED	SWEET PREFERRED	TOTAL
August 10	4	9	13
August 12	2	13	15
August 15	2	11	13
Total	8	33	41
Per cent	19.5	80.5	

To summarize, the two hybrids Hawaii Sweet × Golden Cross Bantam and Philippine Sweet × Golden Cross Bantam were the best

in quality and among the best in yield. These hybrids were erect, of medium height, and of other good agronomic characters. Either of them is superior to other sweet corn varieties so far tested in the Philippines.

HYBRID SEED CORN PRODUCTION

New seed of sweet corn hybrids, like any other corn hybrid seed, must be produced each season. P51 combines well with Philippine Sweet and Hawaii Sweet, but the inbred is not vigorous and is difficult to maintain in the Philippines. Crosses with Golden Cross Bantam are almost as good in yield and better in quality. It may therefore be desirable to use Golden Cross Bantam rather than P51. If so, it would probably be necessary or desirable to import from the U.S. each year the small amount of seed needed for the crossing blocks.

Crossing blocks should be isolated ¼ kilometer from any other corn. Golden Cross Bantam should preferably be used as the seed parent because of its shorter plants and very uniform silking although it can be used as the pollen parent if necessary.

Crossing blocks usually consist of three rows of the seed parent to one row of the pollen parent, but they can be six rows of the seed parent to two rows of the pollen parent. Philippine Sweet should be planted 10 to 12 days earlier than Golden Cross Bantam so that flowering will occur at the same time. Detasseling should be done every day or at least every other day before the start of pollen shedding and continued as long as necessary. It is particularly necessary to pull the tassels from all low suckers to insure clean detasseling.

Quick and thorough drying of sweet corn is necessary to insure high seed germination. Sweet corn seed is particularly vulnerable to molds and kernel fungi so that it should be harvested early, artificially dried immediately to about 12 per cent moistore, and stored in a place where the grain will not absorb moisture. Seed treatment with a fungicide to control fungi and with dieldrin to avoid damage by ants is desirable.

FOUR METHODS OF GERMINATING AFRICAN OIL PALM SEEDS [1]

NELIBALDO S. SAVELLANO

WITH ONE TEXT FIGURE

Removing the pericarp from seeds but keeping the shells intact and soaking seeds without pericarp in 1 per cent HCl were the most promising treatments. Soil medium did not significantly affect germination.

The African oil palm (*Elaeis guineensis* Jacq.), introduced into the Philippines in 1899,[2] is commonly used for ornamental purposes in Manila and in larger towns. Interest in this plant has been revived because of the shortage of certain substances used in processing vegetable shortening which are found in African palm seed oil. In anticipation of an increased demand for planting materials, this study to find the best method of germinating the seeds locally was conducted from October, 1954, to August, 1955.

MATERIALS AND METHODS

Three soil media were used: (1) pure sand from the Molawin creek, (2) garden soil from the upland field of the Central Experiment Station, and (3) compost consisting of wood ash, decayed leaves, and grass. They were sterilized separately by heating for five hours. Four seedboxes were filled with the sterilized soil media and arranged on a strong wooden bench.

The four germination methods tried were planting the seeds (1) with pericarp intact, (2) without pericarp but shell intact, (3) without pericarp and shell broken, and (4) without pericarp but soaked in 1 per cent HCl for two days (fig. 1). The pericarp was removed with a knife, and the seeds were cracked with a bench clamp. Three hundred seeds were soaked in 3 liters of 1 per cent HCl solution for two days.

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[1] Central Experiment Station Contribution No. 1876. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Agronomy under the direction of Assistant Professor Jose R. Mondoñedo.

[2] D. S. Correll, *Lloydia*, 7, 101 (1944).

Fig. 1.—Seeds of African oil palm differently treated: (a) with pericarp intact, (b) without pericarp but shell intact, (c) without pericarp but soaked in 1% HCl for two days, (d) without pericarp and shell broken. (*Photographed by the Photographic Division.*)

One hundred seeds were planted 3 inches deep in every seedbox. All the seedboxes were exposed to the sun and watered morning and afternoon.

RESULTS AND DISCUSSION

Days from planting to emergence of shoots. Seeds without pericarp but soaked in 1 per cent HCl for two days germinated earliest (table 1). Because of the softening action of HCl on the shell, absorption of water probably increased and resulted in earlier germination. However, if water absorption were the only limiting factor in germination, cracking the hard shells would be expected to hasten germination. This was not the case in this experiment. It may be that the seeds had a long resting period as indicated by the long germination period regardless of treatment.

There was no significant difference in germination between seeds with pericarp intact and seeds without pericarp but with shells

TABLE 1.—*Number of days from planting to emergence of shoots*

TREATMENT	MEDIUM			TOTAL	MEAN
	Sand	Soil	Compost		
With pericarp intact	128	143	128	399	133
Without pericarp but shell intact	131	125	142	398	133
Without pericarp and shell broken	166	143	162	471	157
Without pericarp but soaked in 1% HCl for two days	103	109	131	343	114
Total	528	520	563	1611	
Mean	132	130	141		

SMD (T) at 5% = 22.68.

intact. The least desirable of the treatments was cracking the shells. The medium did not show any significant influence on the rate of germination.

Percentage germination. The percentages of germination of the treated seeds differed significantly (table 2). Germination was not significantly affected by the medium. Seeds soaked in 1 per cent HCl for two days had the highest mean of 75.7 per cent. Seeds without pericarp but with shells intact was next, followed by seeds with pericarp intact. Seeds that were cracked had the lowest mean germination. These results conform with the findings of Gurtler as cited by Correll.[3]

TABLE 2.—*Percentage germination transformed into angles* [a]

TREATMENT	MEDIUM			TOTAL	MEAN	MEAN PERCENTAGE
	Sand	Soil	Compost			
With pericarp intact	56.17	50.77	46.72	153.66	51.33	70.7
Without pericarp but shell intact	65.65	60.00	54.33	179.98	59.99	75.0
Without pericarp and shell broken	20.27	17.46	21.67	59.40	19.90	11.6
Without pericarp but soaked in 1% HCl for two days	62.03	58.69	60.67	181.39	60.46	75.7
Total	204.12	186.92	183.39	574.43		
Mean	51.03	46.73	45.92			

[a] Based on 100 seeds.

SMD (T) at 5% = 6.44.
SMD (T) at 1% = 9.75.

[3] *Ibid.*

Eaton, as quoted by Correll, found that palm propagation could be hastened by a medium of nearly pure sand about 1 foot deep. In the present study the medium made no significant difference on the percentage of germination.

Height of plants and number of leaves. Four months after planting, plants from seeds soaked in 1 per cent HCl were the tallest, with a mean height of 3.3 centimeters and a mean number of leaves of 1.3; plants from seeds without pericarp but with shells intact, a mean height of 1.9 centimeters and a mean number of leaves of 0.9; plants from seeds with pericarp intact, a mean height of 1.6 centimeters and an average of 0.8 leaf. Seeds without pericarp and with shells broken had not germinated yet at that time. The differences in height and number of leaves, however, were not significant. Likewise, there were no significant differences based on the media used.

At the end of the eighth month, differences in height and number of leaves based on media and treatments were not significant.

TABLE 3.—*Average height of plants in centimeters eight months after planting*

TREATMENT	MEDIUM			TOTAL	MEAN [a]
	Sand	Soil	Compost		
With pericarp intact	21.0	13.7	20.1	54.8	18.2
Without pericarp but shell intact	21.8	21.6	20.4	63.8	21.2
Without pericarp and shell broken	16.9	24.2	11.9	53.0	14.3
Without pericarp but soaked in 1% HCl for two days	22.5	21.9	22.8	67.2	22.4
Total	82.2	81.4	75.2	238.8	
Mean [a]	20.5	20.3	18.8		

[a] Not significant.

TABLE 4.—*Average number of leaves of the plants eight months after planting*

TREATMENT	MEDIUM			TOTAL	MEAN [a]
	Sand	Soil	Compost		
With pericarp intact	4.2	3.0	4.1	11.3	3.8
Without pericarp but shell intact	4.1	4.4	3.8	12.3	4.1
Without pericarp and shell broken	3.5	4.4	2.5	10.4	3.5
Without pericarp but soaked in 1% HCl for two days	4.4	4.1	4.1	12.6	4.2
Total	16.2	15.9	14.5	46.6	
Mean [a]	4.4	4.0	3.8		

[a] Not significant.

Seeds soaked in HCl produced the tallest plants, which were 22.4 centimeters in height and had an average number of leaves of 4.2 (tables 3 and 4). Seeds without pericarp and with shells broken were the latest to germinate and produced the shortest plants with a mean height of 14.3 centimeters and a mean number of leaves of 3.5.

Other observations. The presence of a few polyembryonic seeds was observed among the seedlings.

How Love burns through the Putting in the Seeds
On through the watching for that early birth
When, just as the soil tarnishes with weed,
The sturdy seedling with arched body comes
Shouldering its way and shedding the earth crumb.

Robert Frost

PROGRESS REPORT: SAND CULTURE EXPERIMENT WITH COCONUT [1]

J. R. Velasco and S. N. Fertig [2]

WITH FOUR TEXT FIGURES

Cadang-cadang has been claimed to be a virus disease,[3] but evidence of its virus nature is insufficient. On this account, we thought it not superfluous to explore the possibility of cadang-cadang being a physiological disease. The study being reported here aims to delimit the response of coconut seedlings to various planes of nutrition and, if warranted, to relate the disease with the deficiency symptoms of an essential element.

MATERIALS AND METHODS

In September, 1954, one hundred nuts which had been in propagating beds for about a month and which had from 1 inch to 1 foot of plumule were obtained from the Department of Agronomy. They were allowed to develop further in shallow concrete tanks in which about 2 inches of water was maintained. On April 20, 1955, when the seedlings were about 260 days old, they were transplanted in acid-washed sand. Each plant was allowed about 44 kilos of sand in a pot 38 cm. in diameter and 34 cm. deep.

The sand was bought from the glass factory of San Miguel Brewery, which mines it from the shore of an island in the Palawan group. After thorough washing with tap water and two treatments with 2 per cent hydrochloric acid, the sand on analysis gave 98.7 per cent silica and traces of iron and phosphate.

In transplanting, the seedlings were severed from the nuts. The food store of the seedlings was removed to aggravate the deficiency of the nutrient and hasten the manifestation of deficiency symptoms.

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[1] Central Experiment Station Contribution No. 1877. Research Project No. 529.

[2] The authors acknowledge with gratitude the assistance in this project of Misses Teofila E. Cabrera and Lucila Espiritu and Mr. R. K. de la Fuente.

[3] G. O. Ocfemia, *Philippine Agriculturist*, 26, 338 (1937).
M. S. Celino, *Phil. Jour. Agric.*, 13, 109 (1947).

The plants were kept in diffuse light for one month and watered with Hoagland's solution No. 2 to allow them to re-establish themselves. They were then gradually subjected to direct sunlight for another month. Those which did not produce new leaves were not considered re-established and were eliminated.

On August 1, the established plants were distributed into lots of four and given the following modified solutions to induce deficiency of each of the nutrient elements:

TREATMENT	SALT CONCENTRATION			
	KNO_3 0.006 M	$Ca(NO_3)_2$ 0.004 M	$MgSO_4$ 0.002 M	$NH_4H_2PO_4$ 0.001 M
Complete + micro [a]	✓	✓	✓	✓
Complete — micro	✓	✓	✓	✓
Minus ammonium	✓	✓	✓	(NaH_2PO_4)
Minus nitrate	(KCl)	($CaCl_2$)	✓	✓
Minus sulfate	✓	✓	($MgCl_2$)	✓
Minus phosphate	✓	✓	✓	(NH_4Cl)
Minus calcium	✓	($NaNO_3$)	✓	✓
Minus potassium	($NaNO_3$)	✓	✓	✓
Minus magnesium	✓	✓	(Na_2SO_4)	✓
Espino & Juliano	$(NH_4)_2SO_4$ 0.019	✓ 0.019	✓ 0.096	(KH_2PO_4) 0.019

[a] The complete culture solution was Hoagland's solution No. 2; the salts in parenthesis were substituted for the corresponding salts of Hoagland at the same concentration.

Monthly observations were made on height to the tip of the tallest leaf, height to the angle made by the petioles of the two youngest leaves, diameter of the stem at the brim level of the pot, and visual changes.

RESULTS

General observations. On September 24, many cultures were noted to have water-soaked specks among the older leaves very suggestive of cadang-cadang symptoms. The spotting seemed to be severe in the minus potassium culture but was pretty general in all cultures, even in the complete culture, so that it was suspected to have been occasioned by the rigors of transplanting. Nevertheless, so as not to lose sight of a possible lead, some plants from the Tiaong Coconut Experiment Station [4] were started in cultures with varying levels of potassium.

[4] Obtained through the help of Mr. Pedro A. Rodrigo, Chief of the Station.

In this second experiment, a convenient way of starting the seedlings in the sand was incidentally hit upon. The husk of the five-month-old seedling was removed, exposing the developing roots and the point of union of the seedling with the nut. The idea was to free the roots of entanglement and to make it easy later to detach the seedling from the nut. The seed and nut was planted in the sand. In 20 to 30 days new roots were formed, and this was taken as a sign that the seedling could safely be severed from the nut. After severance, the nut was dug out. No plant was lost by following this procedure.

Visual symptoms. The first visual change was noted on September 14 when the minus sulfate lot tended to have young leaves with yellowish tips. The yellowing became more and more severe as the experiment progressed.

The second observation on November 7 showed the following visual changes in the different cultures:

(a) Espino and Juliano—healthy young leaves; water-soaked specks on older leaves; specks coalesced and became brown blotches on very old leaves.

(b) Complete Hoagland's solution—plants like those in Espino and Juliano's solution except that they were slightly smaller.

(c) Minus micronutrients—just as healthy as the complete culture.

(d) Minus phosphate—apparently normal.

(e) Minus sulfate—stunted and yellow; the earliest to manifest definitely the symptoms; the most severely affected.

(f) Minus nitrate—generally yellow; water-soaked areas on the old leaves.

(g) Minus ammonium—some young leaves tended to be pale green; water-soaked specks on old leaves up to the third leaf from the youngest.

(h) Minus potassium—water-soaked areas more numerous than on any other culture; specks coalesced and turned brick red to brown.

(i) Minus calcium—leaves tended to point straight upward.

(j) Minus magnesium—apparently normal; had orange to brown blotches on the older leaves.

Figures 1 to 3 show some of the plants. Differences in general appearance are noticeable, but details of the water-soaked areas do not show.

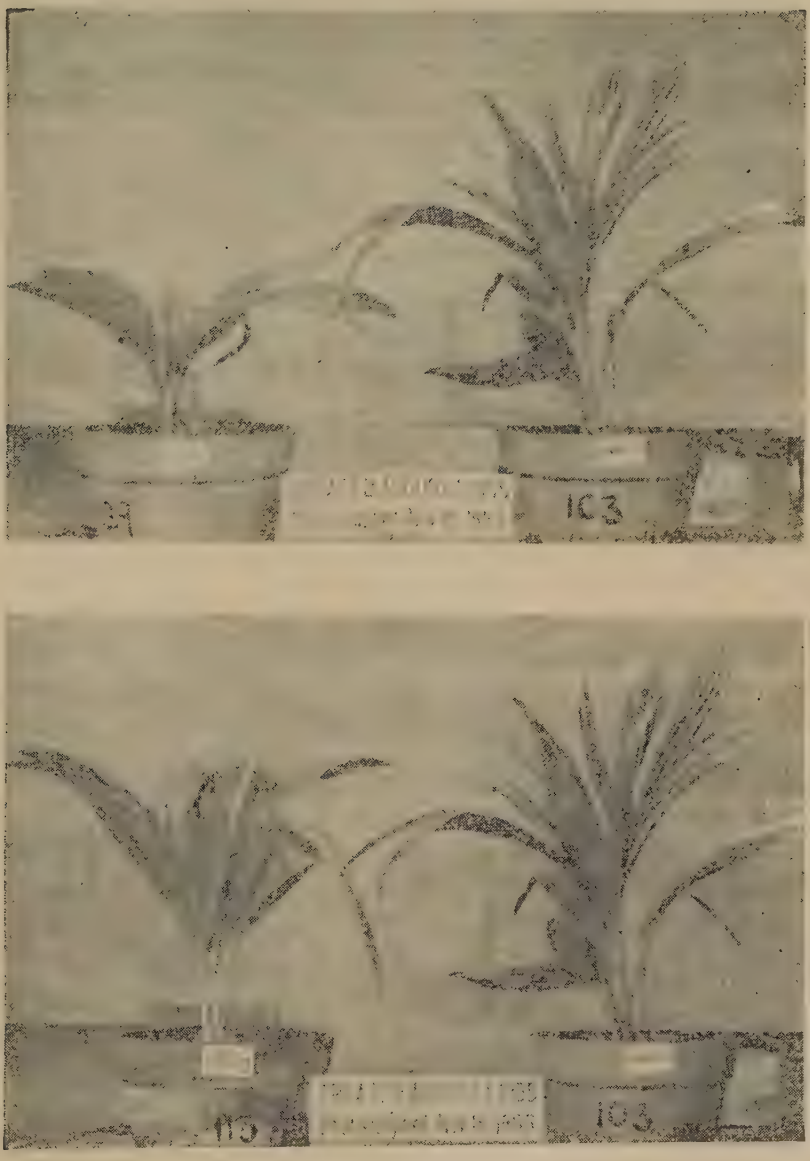

Fig. 1.—Upper, minus sulfate culture. The plants were very much stunted; leaves generally yellow; symptoms showed up distinctly much ahead of those in $-NO_3$ culture. Lower, minus nitrate culture. The young leaves were pale green, but there did not seem to be any marked diminution in growth.

Fig. 2.—Upper, minus ammonium culture. The young leaves were slightly pale green; no marked effect on growth. Lower, minus potassium culture. Plants were variable. The water-soaked specks on the older leaves tended to dry up into brown spots.

Fig. 3.—Minus calcium culture. The leaves tended to remain tucked in.

At the time of writing on February 8, the plants showed very little further change. There seemed to be a tendency for the plant in the minus ammonium culture to regain normal appearance. This may be an adaptation of the plant to the minus ammonium environment.

Height, diameter, and number of leaves. Figure 4 shows the height of plants to the tip of the tallest leaf. The curves seem to form a central sheaf made up of the control culture and the cultures deficient in micronutrient, potassium, ammonium, phosphate, calcium, and nitrate. The differences among them can probably, up to this point, be safely assigned to normal fluctuations. On the sixth month of the treatment the curve for Espino and Juliano's culture swerved upward while that for the minus sulfate culture took a downward turn.

No marked differences could be discerned in height and diameter of stem and in number of leaves.

DISCUSSION

The water-soaked specks on the older leaves of coconut have been widely held to be the characteristic symptom of cadang-cadang. The gradual reduction of the crown and the total failure to produce fruits are regarded as secondary symptoms.

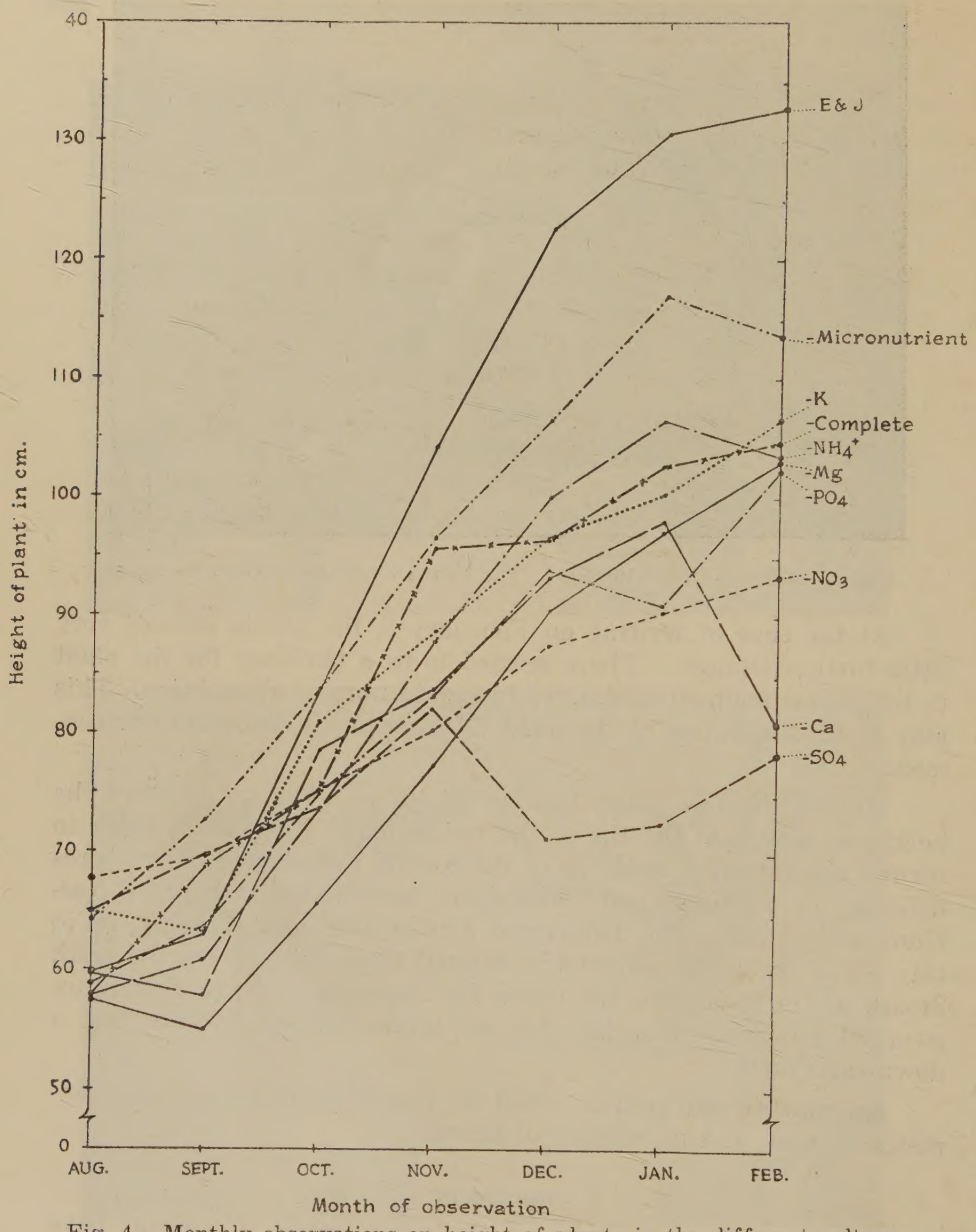

Fig. 4.—Monthly observations on height of plants in the different cultures.

If the water-soaked specks are taken as the sole symptom of the cadang-cadang disease, then it can be claimed that the disease has been artificially produced in our cultures. This was done by the simple expedient of excising the young plant from its food store. Most probably the specks were due to starvation for a nutrient, the identity of which has yet to be ascertained although potassium seems to be that nutrient.

The observation on the excised seedlings brings to mind the common observation in the Bicol region that plants late in their bearing age succumb to cadang-cadang and that the youngest plant to come down with the disease is a five-year-old. At any rate, there has not been an authentic report of cadang-cadang of coconut seedlings in the field. This may be due to the fact that the food store in the nut can tide the seedling over prolonged periods of starvation.

Some questions are worth thinking about: (1) Is cadang-cadang a case of deficiency of mineral nutrients like potassium, ammonium, and nitrate or is it starvation for elaborated food like starch and protein? (2) If it is the former, is the nutrient deficiency resident in the soil *per se* or is it a deficiency brought about by certain unfavorable conditions or microorganisms in the soil? (3) How will it be related to the high nematode count [5] in soil of cadang-cadang areas?

The present evidence does not seem to lend substance to the virus theory of cadang-cadang. For one thing, it is generally held that virus infection is heaviest in the young portions of the plant rich in protoplasm. Cadang-cadang, on the other hand, affects the old leaves and the old trees.

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[5] Personal communication from Dr. A. G. Newhall, former visiting professor of plant pathology from Cornell University.

A child said *What is the grass?* fetching it to me with full hands;
How could I answer the child? I do not know what it is any more than he.

Walt Whitman

ERRATUM

Errata, line 4, of number 8 (January, 1956), vol. 39, for "'*Matthiola insana* R. Br. var. annua'" read "*Matthiola incana* R. Br. var. annua."